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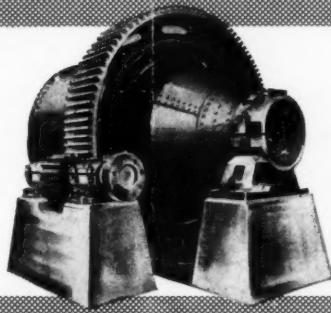
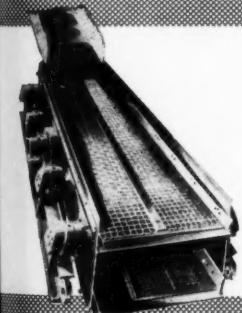
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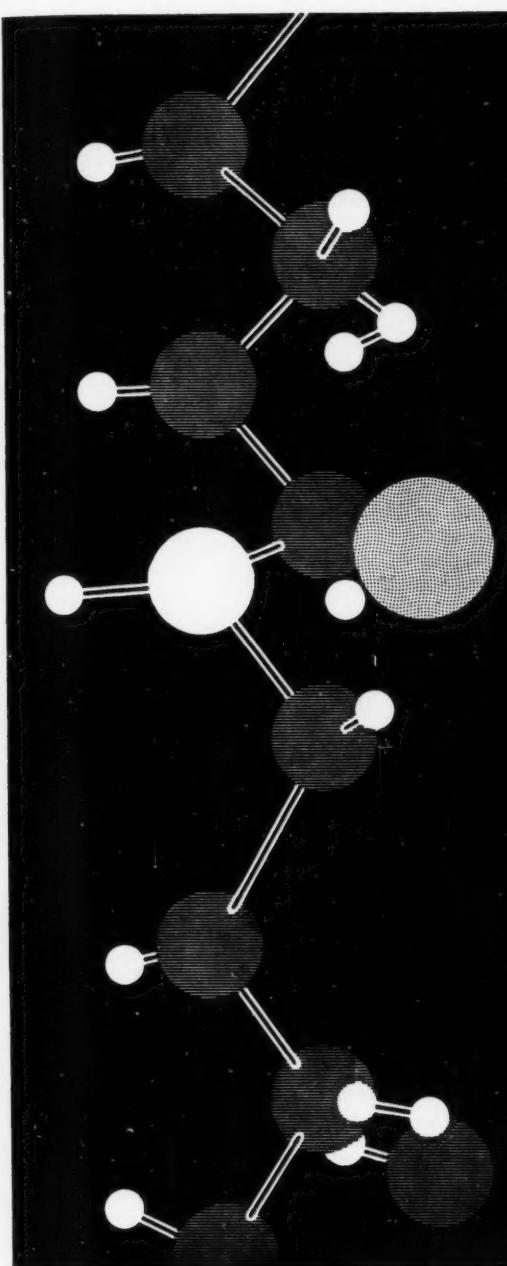
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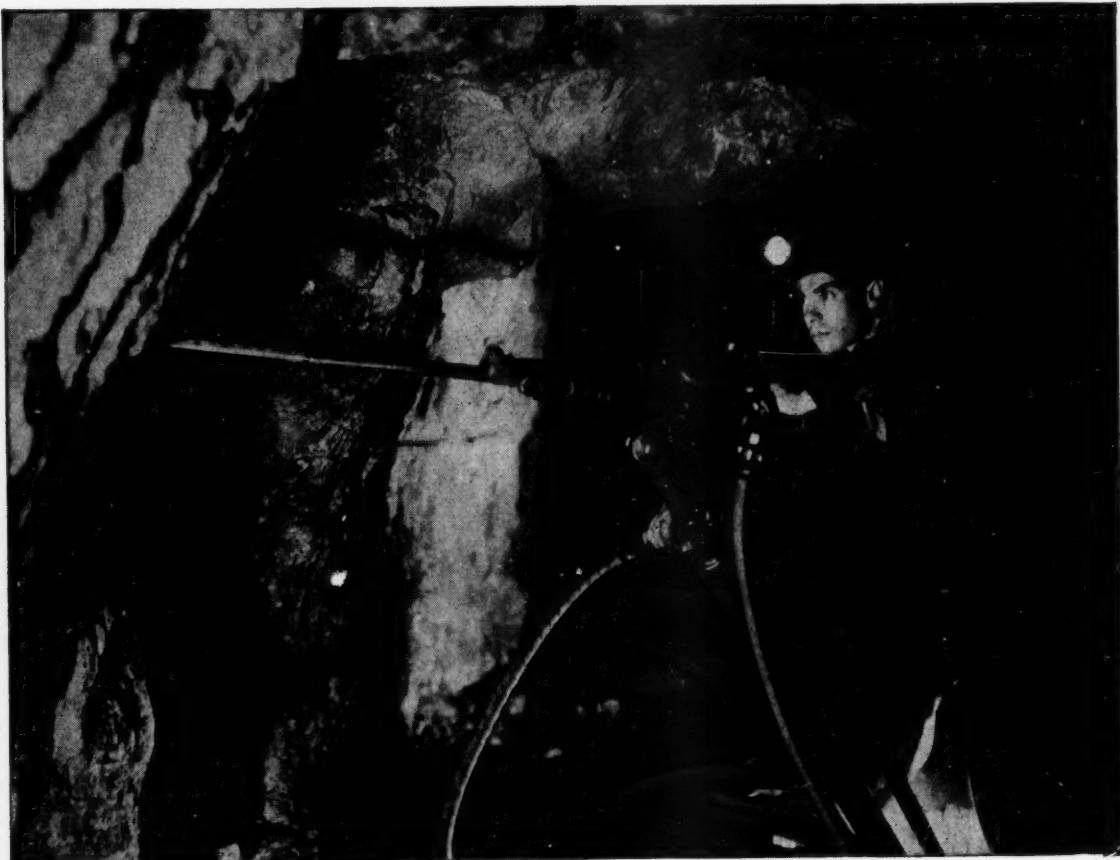
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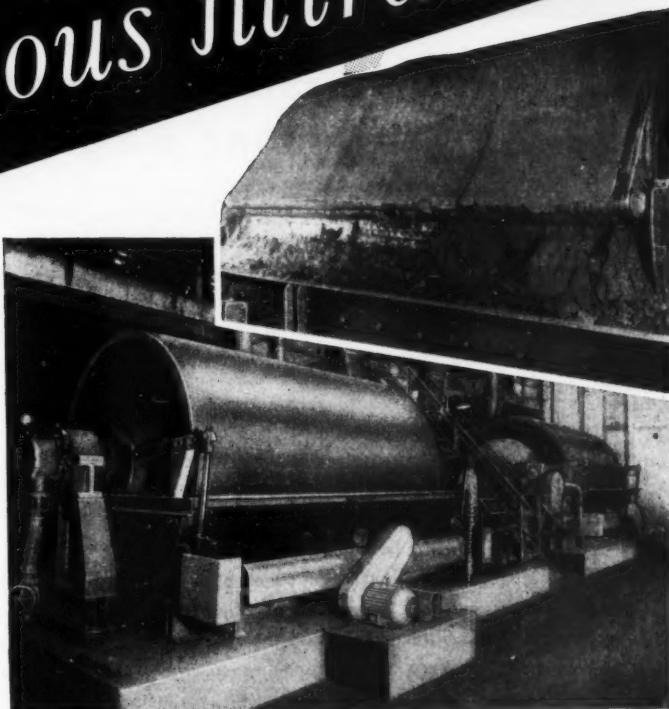
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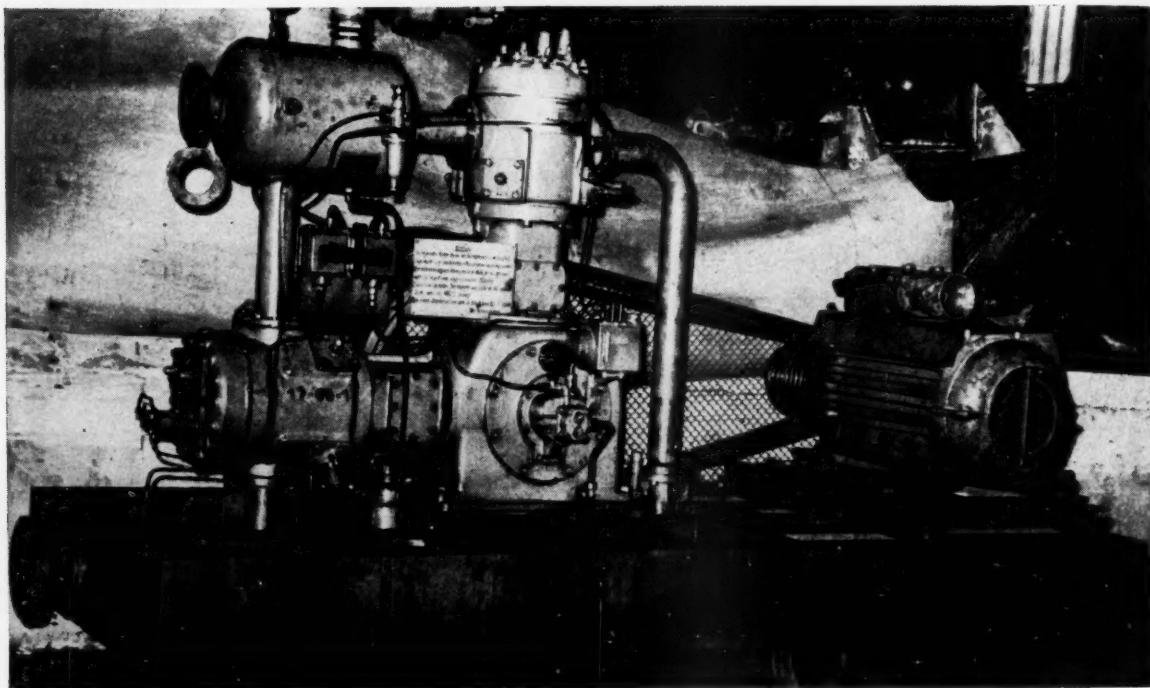


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The Mining Journal

London, March 25, 1960

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Editor

U. Baliol Scott

Deputy Editor

A. Graham Thomson

Assistant Editor

R. Bowran

Assistant Financial Editor

R. A. Nuttall

Display Advertisement Manager

E. S. Hooper

Circulation

Robert Budd

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The Objectives of Mineral Procurement Policy

IT is axiomatic that an adequate, dependable and continuing supply of raw materials is of prime importance to industrial nations in meeting the needs of expanding populations at home and abroad, rising standards of living, and security programmes. Unfortunately the development of the Commonwealth's mineral resources has suffered from an unco-ordinated and *ad hoc* approach to problems of supply, due largely to the absence in government circles of a clear understanding of the basic aims and requirements of minerals procurement policy.

So far as Whitehall is concerned, the unique circumstances of the overseas mining industry and its importance to our future economic stability has yet to be sufficiently realized, though in fairness it should be added that, of late, indications of a more realistic appreciation of the industry's needs have been afforded by the more favourable fiscal treatment accorded to mining companies acquiring O.T.C. status and by the establishment of a national mineral research laboratory. Another encouraging development is the growing attention which has latterly been accorded to the development of the newer metals as engineering materials, due largely to the aircraft and missile programmes and to the requirements of the Atomic Energy Authority.

In general, however, Whitehall lags far behind Washington in discharging its responsibility for raw material supplies and their efficient utilization. Whatever the merits or demerits of particular aspects of U.S. minerals policy, it can scarcely be disputed that the American Government has built up an organization for minerals procurement which is unsurpassed.

We are indebted to Charles W. Merrill, Chief, Division of Minerals, U.S. Bureau of Mines, in his introduction to *Mineral Facts and Problems*, 1960 Edition, for setting out very clearly and concisely the role and objectives of the U.S. Government in this supremely important field. The role of government is defined as being to help further long-range research projects where the hope of immediate commercial operation is not attractive to industry. Such helpfulness lays the groundwork for later development by private industry. In addition, government is responsible in providing for the national security and assisting industry, for solving short-term problems. These responsibilities entail a continuing review of the national position in every material of strategic or domestic significance and dissemination of comprehensive statistical data to other government agencies and to the public.

The major objectives of U.S. minerals policy, it is stated, are: (1) Wise production and utilization of mineral resources; (2) discovery and development of new sources of mineral supply; (3) maintenance of mineral reserves and stocks at adequate levels; (4) fostering of a productive and processing industrial capacity large and

flexible enough to exploit effectively the domestic mineral resources consonant with fully foreseen requirements; and (5) assurance of access to foreign mineral supply to supplement domestic output as needed.

It is pointed out that major decisions in industrial development and expansion, foreign affairs, international trade, defence, and in many other areas, frequently require reliable and comprehensive information on the nation's mineral position. Government agencies charged with the responsibility of conducting U.S. foreign affairs, as well as those charged with procurement of materials for defence and internal development, must know the country's mineral position. Congress likewise depends on objective, authentic information, so that its legislative decisions may be based on facts. Perhaps most important of all is an informed private industry because its agents make so many of the major decisions involving minerals.

On the subject of submarginal resources, the point is made that a demonstration of the existence of very large quantities of materials is a powerful incentive to private enterprise to attempt commercial development. The early phase of research in submarginal resources normally falls to government, but Merrill states that privately financed organizations frequently undertake such development long before profitable operation can be assured. The United States also has large deposits of mineral raw materials for which comparatively little use has been found, such as high-alumina clay and anorthosite for the production of aluminium and vast reserves of lignite and peat. Means of utilizing the metals or minerals in such deposits could relieve a serious drain on materials in short supply.

Other fields for government research are in the development of substitutes and in conservation. In the United States the progressive substitution of aluminium for tin in tubes and foil has replaced an imported metal with one in more abundant domestic supply. Basically, conservation entails wise use—not hoarding. Wise use in the mineral field includes the following: high eventual recovery of material from the ground and of the valuable constituents of such material; recovery at the time needed; fabrication or other preparation for use with minimum waste or loss of the valuable material; efficient utilization through superior design in fabrication or high conversion to energy in combustion; utilization or storage of co-products and by-products; application to purposes of high economic utility; and utilization of substitutes, where available, for other important materials that either are in limited reserve or have singular use characteristics.

Increased mineral utilization is fostered by mineral-industry studies that point out commercial opportunities resulting from scientific and technical discoveries affecting minerals and from economic advances in other fields. Discovery of ore-bodies, proof of sizeable reserves, and development of new or more efficient extraction methods, coupled with new or improved sources of energy from mineral fuels to convert such ores to useful products, present new opportunities for consumers and communities.

On the other hand, increasing populations, advancing industrialization, new applications, and other elements of demand will call for a review of latent or partly developed resources as a new or expanded source of supply. Mineral-industry studies attack such problems of supply-demand adjustment on a national basis and on regional bases where appropriate.

The avenues of attack on mineral problems range from basic or pure research on the properties of minerals to the testing of specific ores as to their amenability to particular processes. The U.S. Government regards itself as having a unique role in co-ordinating and integrating research in the mineral industry. After outlining some considerations in its approach to research and mineral-industry studies, Merrill makes the broad general statement that to be most useful

and in the greatest public interest, Federal research should not be competitive with other research and should concern itself with national needs, directing itself towards long-term objectives much more than privately financed work.

There is nothing in these objectives inconsistent with the requirements of a minerals procurement policy for Britain and the Commonwealth, nor, indeed, are there any aims which, in our spasmodic and piecemeal way, we have at one time or another not sought to achieve. What we chiefly lack is a positive and clearly formulated policy, an organization through which government could adequately discharge its responsibilities as defined by Merrill, and above all machinery for the continuous collection and dissemination of information on world production and consumption, stocks and trends, which is a basic requirement of long-term minerals procurement policy.

BAUXITE NOW SARAWAK'S LEADING MINERAL EXPORT

Oil from the Miri field, which has been Sarawak's leading mineral export for 40 years, has yielded first place to bauxite, according to the latest report from Kuching.

Miri oil production in 1959 totalled 395,000 barrels, valued at \$M2,882,000 or £336,233 with \$M1 equivalent to 2s. 4d. Bauxite exports from west Sarawak amounted to 203,000 tons worth \$3,843,000 (£448,350), more than double the weight exported in 1958. Actual production of bauxite was 207,000 tons, and further substantial increases are planned for 1960. Already, a stockpile of 50,000 tons has been accumulated at Sematan, 40 miles west of Kuching.

Bauxite mining at Sematan began in 1958. The deposit being worked is at Munggu Belian, in undulating country about half-a-mile from Sematan; it is estimated that it will yield over 2,600,000 tons of washed bauxite. The ore occurs in a bed about 10 ft. thick, under a thin cover of soil. It is worked by excavators, cleaned at Sematan washing plant and stockpiled for loading into steel lighters which deliver the bauxite to ocean freighters.

Output is increasing steadily as more equipment is brought into use. A new washing plant completed last year gives, with the old plant, a maximum potential output of 1,500 tons every 24 hours. The wharf is being extended so that round-the-clock loading can take place this year. Together with other improvements, these developments should give a loading rate of 250 tons every 30-40 minutes during the shipping season.

During the wet season (November-March) the mine is working 16 hours a day. It is hoped that a stockpile of 100,000 tons will be ready when shipping begins. "These arrangements", says a Sarawak Government announcement, "should allow 300,000 tons of ore to be exported this year".

Since bauxite was first found by the Geological Survey in 1949, over 20 occurrences have been discovered in Sarawak. In addition to the main deposit, a further possible 250,000 tons has been discovered at Munggu Belian during recent tests. Some of this, however, is below considerable overburden and must be worked by dragline. Two deposits, at Bukit Gebong (3½ miles from Munggu Belian) and Tanjong Serabang are being further investigated; others will be tested in due course and further prospecting is planned. It is believed that 2,000,000 tons of washed bauxite might be obtained from the Bukit Gebong deposit.

A Sarawak Government news release comments: "It is most valuable for assessing bauxite potentialities to have proved at last what has long been postulated—namely, that bauxite occurs below the coastal terrace sands and swamp deposits. . . . Equally important is the finding of an effective method of testing these alluvium-covered deposits. A small, mechanically-driven drill has proved successful for this work.

MINERALS IN BRAZIL'S EXPORT DRIVE

To facilitate sales abroad at world prices, Brazil has included all metals and minerals (raw materials, semi-manufactured and finished products) in the list of articles for which exporters may sell their bills on the free exchange market. Instead of receiving immediately the free rate in full, which is now 183 cruzeiros per U.S. (512.50 per £), exporters will receive a fixed amount of 130 crs. per dollar, or the equivalent in other currencies, and the balance in treasury bonds, redeemable in six months with interest at 6 per cent p.a. Hitherto exporters have received 100 crs. per dollar for metals and minerals sold abroad.

Exports of niobium minerals, of which large quantities exist in Brazil, are now controlled instead of being prohibited, reports our Correspondent. The president of the National Commission for Nuclear Energy, says that 360,000,000 tonnes of 4 per cent niobium exist at Araxa, Minas Gerais alone, and exporters, who have already disposed of 10,000 tons abroad, undertake to separate the small quantities of thorium and uranium contained in the mineral and hold them for sale to the Commission.

A method is being studied to extract the uranium from Olinda phosphates while processing the latter. These deposits have measured reserves of over 49,000,000 tonnes and a P_2O_5 content ranging from 6 to 22 per cent. They are being mined and industrialized on a large scale by a consortium of firms.

The first shipments of 12,000 tonnes of Brazilian manganese have left Nueva Palmira, in Uruguay, for United States. The ore mined at Urucum, Mato Grosso (see *The Mining Journal*, July 31, 1959), was shipped from Corumba over the Parana and Uruguay Rivers to the free port of Nueva Palmira, where it was concentrated, the concentrates being transported by lighter to ocean-going steamers. Nueva Palmira has been equipped by United States Steel, which participates in the exploitation of the Urucum deposits. The port has been built, provided with large underground deposits, mineral quay and mole, and all handling operations mechanized. The Parana and Uruguay Rivers are only navigable throughout during approximately six months of the year.

TECHNOLOGICAL EDUCATION — SOME AMERICAN VIEWS

Closer links between mining, metallurgy and chemical engineering in the development of new alloys and materials of greater capability will follow from the new requirements for space age metals in missile structures, electronic instrumentation and related equipment. This trend, together with some of its implications, particularly the need for realignment of education in mineral engineering and metals science, were discussed by the American Institute of Mining, Metallurgical and Petroleum Engineers at its recent convention in New York.

Dr. Robert F. Mehl, in his lecture to the Iron and Steel Division of the Institute, pointed out that the newer metals, for the most part, had come from the efforts of the chemical industry. He wondered whether the field of extractive metallurgy might not pass out of the hands of the metallurgist and be taken over by the chemist, and especially by the chemical engineer. This he regarded as a real challenge to the metallurgical profession. Dr. Mehl urged the need for a marked increase in research in the field of extractive processes in order to attract more students and expressed concern at the loss of good research men to industry through their diversion to unchallenging technical jobs.

The value of research as the key to a better future for the metallurgical industry was also stressed by Dr. Carleton C. Long, the newly installed president of the Metallurgical

Society of the A.I.M.E. Dr. Long said that the sudden demand for certain metals, such as uranium and metals of the rare earth group, had given great emphasis to metallurgical research in extraction techniques. Solvent extraction and ion exchange processes were now used commercially in the extractive metallurgy of uranium. These processes were also used in extracting other metals of similar or higher price. Autoclave oxidation and reducing techniques had been used commercially in the production of cobalt metal and nickel. In fact, a significant amount of the American continent's supply of nickel was now derived through the use of an autoclave process.

Due to this success in basic science, said Dr. Long, metallurgical engineers were coming to realize the great advantage derived by considering their profession to be concerned with the study and useful application of materials, rather than with metals only. The concept of "materials engineering" as an outgrowth of metallurgical engineering was the source of considerable ferment in academic institutions.

Dr. Arthur B. Cummins, the new president of the Mining Engineers Society of the A.I.M.E., called for more adequately trained engineers for minerals research, exploration, management, operations and the specialized technical fields. He, too, predicted that there would be an increasing fusion of the mining and chemical industries.

At a session on education, Mr. Charles M. Brinckerhoff, president of Anaconda, said that, in view of the great changes being experienced by the mining industry, only a relatively few mining engineers were required. The need for the old concept of a mining engineer trained broadly in many fields had greatly decreased. In his place were needed engineers with more training, capable either of specializing or of developing eventually into administrative work in any branch of the extractive industries.

Mr. Brinckerhoff contended that those in charge of engineering education must develop programmes better suited to the drastically changed situation in the extractive industry and should broaden the mining engineering course to include the entire field of metals, non-metallics and fuels, their recovery from the natural state, and their preparation for market. The curriculum he advocated covered general courses in geology, mining, metallurgy, industrial chemistry, metal fabricating, petroleum engineering, and the engineering of non-metallic minerals. Such a curriculum, he pointed out, would leave room on a post-graduate basis for the development of specialists in the field of advanced geology, ore dressing, chemistry and automation.

A unified engineering-science education programme in metallurgy was advocated by John E. Dorn, professor of engineering science at the University of California. Professor Dorn maintained that the time for specialization with appropriate emphasis on metallurgical research or metallurgical engineering and management was at the graduate level. Before that time the student seldom had either the background or purpose to make an effective decision on that important issue. He suggested that two parallel programmes might prove effective: one for the research metallurgist, and another for the production metallurgist and potential manager.

Emphasis was placed at the convention on the urgency of stepping up the enrolment of students in order to provide a more adequate flow of technologists against future needs. Dr. Cummins estimated that the Soviet Union was employing about 40,000 geologists, whereas in the United States student enrolment in geology and related sciences was declining. Dr. John W. Vanderwilt, of the Colorado School of Mines, forecast that, unless the decreasing trend in enrolment could be reversed, there would be a shortage of mining engineers in 1962-66. The enrolment figures suggest that the shortage of mining engineering manpower will be five to eight times that of other engineering fields.

Mining in Sierra Leone

ALTHOUGH illicit activities in diamond mining and dealing had been conducted on a large scale in previous years, the position at the end of 1959 appeared to be much more encouraging. Due to measures taken by the government, illicit mining was only on a small scale and the fact that the official purchases during the twelve months' period reached a record figure of £5,800,000 seemed to indicate that illicit dealing was also decreasing.

Indeed, 1959, was a good year for the diamond industry as a whole for, apart from the increases of £1,600,000 in official purchases, the Sierra Leone Selection Trust also exported diamonds provisionally valued at £3,300,000, the total legal exports thus amounting to over £9,000,000—also a record.

This is undoubtedly an encouraging factor for Sierra Leone's economy and, added to this, the Sierra Leone Development Company, which mines iron ore at Marampa, also established a record with shipments in 1959: 1,600,000 tons as against the previous best of 1,500,000 tons shipped in 1957. This company is increasing its concentrating mill capacity to 2,000,000 tons per annum as from the end of 1961 and also hopes to exploit new deposits in the Tonkolili District which would permit them to increase the annual exports to 6,000,000 tons. However, before the company can embark on a scheme involving vast expenditure, it requires some guarantee that it can market such a tonnage at competitive prices.

Chrome — Titanium — Molybdenum

The position in the chrome mining industry is not so encouraging. Chromite is mined by the Sierra Leone Chrome Mining Company at Hangha, near Kenema and shipments in 1959 totalled only 5,000 tons, whereas the figures for 1957 and 1958 were 15,700 and 14,200 tons respectively. This is due to competition from the Philippines, where chromite of refractory grade has a silica content of 4 per cent compared with the 6 per cent silica content of the chromite shipped from the Hangha deposits of Sierra Leone. Samples of lump ore and of concentrates are being sent to Britain for treatment in a pilot mill to endeavour to decrease the silica content to 4 per cent.

Reconnaissance drilling is being carried out in part of the South-Western Province by the Consolidated Zinc Corporation, in partnership with Columbia Southern Chemicals Corporation, to determine the extent of alluvial concentrations of the titanium-bearing minerals rutile and ilmenite. Upwards of 1,500,000 tons of alluvial rutile have been proved in one deposit near Gbangbana in the Imperi Chiefdom of Bonthe District.

Sierra Leone's economy is basically agricultural in character but the country's mining industry makes an important contribution to revenue. Illicit diamond mining and dealing caused some disruption in the years 1955-57 but today there is little illicit mining and measures are being taken to eradicate illegal dealing. The year 1959, was a record one for diamond and iron ore exports.

Molybdenite (MoS_2) has been found in several parts of Sierra Leone. Associated with galena, blende, chalcopyrite and silver, it occurs near Dalakuru in the Diang Chiefdom of Koinadugu District. Since 1956 geochemical prospecting research teams from the Geochemical Prospecting Research Centre of the Imperial College of Science and Technology, London, have been assisting the search for molybdenum and the Government Geological Survey is diamond drilling an area with high molybdenum values located by this work. In 1960 a party of two from the Research Centre will carry out an investigation for molybdenum in the water of streams and water courses in an area of approximately 150 square miles near Lake Sonfon.

Alluvial gold mining ceased in 1956 but government geologists are continuing their efforts to locate lode gold prospects of which several have been found and await evaluation by drilling and assay. Other minerals known to occur in Sierra Leone include bauxite, columbite and ilmenorutile, pyrochlore, platinum, monazite, corundum, cassiterite, talc and vermiculite.

Nepheline syenite rock, which occurs in the Tunkia Chiefdom of Kenema District, is suitable for use in the ceramic and glass industries.

Official Diamond Buying

The opening of the Government Diamond Office, in August, 1959, marked an important step in dealing with one of the country's most serious problems—the marketing of its diamonds.

Under the Alluvial Diamond Mining Scheme, introduced in 1956, it became legitimate for Africans to mine diamonds. At the same time, the Diamond Corporation established a locally registered company to deal in and export Sierra Leone diamonds. They established a standard which protected the local digger and a system which has enabled Sierra Leone dealers to learn a lot about the valuation of diamonds themselves. But, nevertheless, a large black market continued, operated from vantage points round the perimeter of the country by unscrupulous, but highly skilled and well-organized businessmen.

The loss to Sierra Leone has been very serious. It is estimated that from 1955 to 1957 stones valued over £46,000,000 were smuggled out, mainly over the borders. Legitimate exports were £1,600,000 in 1956, £5,300,000 in 1957, and £4,500,000 in 1958.

It was therefore necessary for the government to find a compromise between the need to promote the maximum competition between outside buyers, which would normally be attained through a free market, and the need to retain the standards and the stability that is provided by the Diamond Corporation of London. Under the new agreement of 1959 the Corporation continued to guarantee to buy stones from the Government Diamond Office until a stockpile of £3,000,000 was accumulated. Furthermore, the agreement provides that Sierra Leone stones will not be held in stock while other stones are sold, so that the Corporation has to have stocks on hand of some £30,000,000 before they will

be entitled to stop buying in Sierra Leone. This represents a very considerable financial risk to the Diamond Corporation but it would be of great importance to Sierra Leone in the event of a serious economic depression.

Thus, the Government Diamond Office has become the sole legitimate exporter of diamonds mined under the Alluvial Scheme and all sales are channelled through it. It is directed by an Executive Board on which the government has a majority. A dealer need not sell to the Government Diamond Office, if he can obtain a better deal by offering his stones for tender on the open market in London.

There is little illicit mining going on in the country today and although illicit dealers are still undoubtedly operating they are being ruthlessly pursued by security personnel.

The 1959 figures for official purchases are, however, most revealing, for a marked increase has been recorded after August—on the opening of the Government Diamond Office—and the purchases in December, valued at £590,000 were three times greater than those made in the same month of 1958. Official purchases for the year totalled £5,800,000, a considerable increase over the 1958 figure—£4,086,000.

Exports by Sierra Leone Selection Trust

These figures do not include the value of stones produced by the Sierra Leone Selection Trust. This company, which first commenced operations in 1934, holds an exclusive lease over about 500 square miles in the South Eastern Province. The leased area which it holds was originally much greater but was reduced when the Alluvial Diamond Mining Scheme came into operation, the company being paid compensation for this reduction by the government.

Selection Trust excavates the diamondiferous gravel with mechanical equipment. The gravel is then transported by dumper or endless rope haulage to be concentrated in the "pan" plants of which ten or more are now in operation.

In 1958 the total quantity of diamonds exported legitimately was 1,490,037 carats valued at £9,500,000 of which the Selection Trust mined 690,000 carats valued at £3,750,000.

At present it is estimated that 55 per cent of the company's profits are paid to the government. From July 1958 to June 1959 the estimate of taxation paid to the government amounted to £1,144,000. If the company's profits should rise the percentage could, under the agreement with the government, go up to 60 per cent. In addition, the company spends about £1,000,000 a year in Sierra Leone on wages, medical services, local purchase, roads, ferries, bridges and grants to local authorities. The company has appointed one African as a mining engineer and is training two Africans as engineers at the Camborne School of Mines, in England.

In the past two years the company has also introduced a contract mining scheme on its own leased area. Under this scheme a local contractor is supplied with equipment to enable him to win diamonds satisfactorily, with a minimum of wastage.

Bright Prospects for Iron Ore

There are bright prospects for Sierra Leone's iron ore mining industry. A record tonnage of 1,600,000 was shipped in 1959 and there is the possibility that if the new deposits at Tonkolili are exploited, exports will go up to 6,000,000 tons per annum in the years ahead.

The Sierra Leone Development Company, a private company, at present has mines at Marampa in the Northern

Province. The mine is connected by a 3 ft. 6 in. gauge railway, 52 miles long, to the loading port of Pepel which is about 12 miles up-river from Freetown.

At Marampa, opencast mining is carried out at the top of Massaboin Hill, some 800 feet high. The powder ore is excavated by 25-ton capacity scrapers which are emptied over a bunker whence conveyor belts transport the powder to the treatment mills, half-way down the hillside.

After treatment, the concentrates, which contain 65 per cent iron and are considered to be of an extremely high quality because of their freedom from impurities, are stockpiled before being loaded into wagons for railing to Pepel. Work is due to commence on a new treatment mill in May, 1960, and when this is completed in the third quarter of 1961, production can go up to 2,000,000 tons a year.

This company began operations in 1933 and has so far exported 23,000,000 tons of ore, the main customers being the United Kingdom (importing approximately 50 per cent of the output), West Germany and Holland, and to a lesser extent the United States and Austria.

The Sierra Leone Development Company and the Selection Trust have provided modern hospitals, apprenticeship schemes with up-to-date training workshops, and comprehensive recreational facilities.

Plans for Expansion

A scheme for expanding the iron ore industry is now being investigated and it is possible that the extension of operations to Farangbaia, Tonkolili District, would provide an additional output of almost 4,000,000 tons a year. This scheme would involve an expenditure in the region of £20,000,000 and to warrant this the mines would have to produce—and the company to sell at competitive prices—300,000 tons of ore each month. The proposals include the construction of 73 miles of railway from Marampa to Farangbaia; the dredging of parts of the Sierra Leone near Pepel to permit ships with a draft up to 34 feet to load cargoes of some 34,000 tons, and construction of a new loading jetty with a loading capacity of 4,000 tons per hour, as well as new railway sidings, oil storage tanks, power station extensions and additional workshops. New administrative buildings, a power house, workshops, housing for 84 senior and 1,000 junior staff, a hospital, market and recreational facilities will have to be provided at Farangbaia.

It is proposed that open cast mining should commence on two hills, Simbili and Marampon, and these operations would be fully mechanized and similar to those carried out at Marampa.

The inauguration of this new scheme would make an important contribution to Sierra Leone's economy, particularly at a time when there is some unemployment.

Importance of the Industry

According to the 1958 statistics Sierra Leone's mining industry provided employment for some 215 supervisory and executive staff and 7,500 others. These figures do not include alluvial diamond mining which it is estimated gave seasonal employment to 15,000 to 37,000 labourers in that year.

Mineral exports in 1958 were valued at £13,100,000, diamonds accounting for £8,500,000 and iron ore £4,500,000. Undoubtedly when the final figures for 1959 are available (diamond exports increased by £1,000,000) it will be seen that the progress being made by the country's mining industry is most satisfactory.

NEW LOADING SYSTEMS ENHANCE SKIP WINDING OF COAL

THE advantages of skip winding in collieries have been considerably enhanced by new skip loading systems designed to safeguard large coal and to simplify the underground sections, particularly by the reduction of excavation. These systems are covered by Patents and Patent Applications in this country and overseas. Indeed, although no Qualter Hall skip loading equipment has been installed overseas, serious consideration is being given to the installation of Qualter Hall skip winding equipment in certain mines in South Africa. Arrangements have been made with Wright Anderson (South Africa) Ltd. for the manufacture of Q.H. skip winding equipment in South Africa.

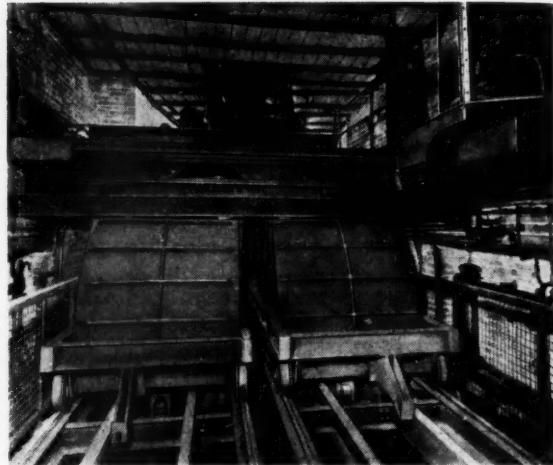
Among new British colliery skip winding plants recently adopted by the N.C.B. have been those for the Bagworth Colliery in the No. 7 Area East Midlands Division and for Thorne in the No. 2 Area, North Eastern Division.

Both these plants have been provided by Qualter, Hall and Co. Ltd., of Barnsley, who have specialized in modern winding and skip loading equipment. Skip loading has been achieved by this company by a number of methods which take the place of the orthodox vertical measuring pocket. These methods include the use of spiral chute measuring pockets or the use of a tipping loading car system which incorporates a ram-controlled hopper car with a gravity-operated tipping body moving between a car loading station and the tipping point alongside the shaft.

Loading at Bagworth and Thorne

At both the Bagworth and Thorne Collieries the new skip winding plants involve the use of underground tipping loading car systems. That at Bagworth was designed to deal with 240 tons per hour, based on an overall skip loading and discharging time of 10 sec. for the complete surface and underground operations, the single deck cages being replaced by two skips. Pit bottom alterations did not entail any major widening but excavations had to be made for the 150-ton spiral surge bunker near the shaft. The existing sump was also deepened 15 ft. Coal is fed to either of the two loading cars by pneumatically controlled traversing chute under which the cars stand on rails supported by an automatic weighing platform. The chute automatically switches to the other car position when the load in one car

The tipping loading car at Bagworth Colliery



Two tipping loading cars in the car filling position below the traversing loading chute. Also visible is the on-setter's control cabin and part of one of the weighing machines

reaches 3 tons, each car being moved forward by the pneumatic ram to facilitate loading over its length. When a car has been fully charged it is held by catches until the appropriate skip is proved in a loading position, when they are automatically withdrawn through valve action, allowing the container to move forward and tip. Immediately after discharging its load, the loading car is retracted and the ascending skip resets the pneumatic car stops.

A wheeled bogie carries the loading car body, which is mounted on a pivot behind the centre gravity, the forward part being supported on rollers running on a rail track inside the bogie track. This roller track slopes downwards at the delivery point, allowing the car body to tip and rapidly discharge its contents into the skip, via a transfer chute. The loading car's door is mounted on the bogie frame so that, when tipping, the nose swings down clear of the door thus releasing the coal.

The sliding chute feeding the loading cars is of the type which allows the conveyor to be running continuously. The surge bunker is used only as a by-pass for use when output exceeds shaft capacity or in case of breakdown. Pneumatic guillotine door opening gear prevents the skip from discharging its load at the surface until it has reached its correct position.

The Resultant Savings

The installation of the Bagworth loading and winding system has resulted in a considerable saving in manpower and an improvement in the overall productivity of the pit by between 3 cwt. and 4 cwt. per manshift.

Two 10-ton capacity skips are to be used in the 22 ft. diameter shaft at Thorne where winding will be at a rate of 480 tons an hour. Again, two loading cars will be used on parallel short lengths of rail, the coal being delivered to them from a tippler at a point about 20 ft. from the shaft. Here, a sliding distributing chute is to be installed to feed the coal into either of the two cars, the cars being moved by pneumatic ram, as at Bagworth, to ensure complete filling.

Originally the loading equipment at Thorne was to have been installed in the pit bottom but recent ground movement has necessitated some floor excavation to lower the loading level about 7 ft.

Minerals Exploration in Dahomey

DAHOMEY does not at present possess any mine capable of economic exploitation. However, an extensive programme of exploration and prospecting was sanctioned last year, when the Government of Dahomey agreed for the first time to finance a project of this nature.

An agreement was signed at the beginning of 1959 between the Government of Dahomey and the Bureau Minier de la France d'Outre-Mer to undertake a programme of geological and mining researches in the interior of the country. In terms of this agreement each of the interested parties will contribute 10,000,000 francs CFA annually to finance these investigations. It was further agreed that the programme should provide for investigation of the following mineral occurrences: gold in the Natitingou area (Perma placer), chromite in Tanguieta (Bontomo), iron ore in Kandi (Loubou-Loumbou), phosphate in the region of Athiéme; rutile in the centre of the country (Pehunco, Soassourou, Djougou, Birni, etc.), and pegmatites (with reference to beryl). The BUMIFOM has been entrusted with the execution of this programme.

It should be noted that of the occurrences covered by the agreed programme, only the Perma gold and the Kandi iron ore deposit have been the subject of studies such as are now to be undertaken.

Perma Placer

The alluvial and eluvial deposits of the Perma River (22 km. from Natitingou) were exploited on quite an important scale during the war, producing up to 35 kgs. of gold per month. The introduction of a new labour code led to operational difficulties, which resulted in the suspension of production. Several years later, a private individual made an unsuccessful attempt to resume exploitation on the lower region of the Perma flats, downstream from the gorges. Since no published information was available regarding the primary deposit, this investigation was begun last June. A mission comprising a geologist, a prospector, a topographer and their teams were sent to Perma to search for and study lodes with the object of investigating the placer gold deposits and the sulphur mineralization of that region. Numerous samples revealed on analysis the presence of small highly mineralized lodes of gold, but these were of too limited tonnage to offer any prospect of economic extraction.

However, this work seems to have directed the researches towards an examination of the prasenites surrounding the quartz lodes. These prasenites were found in some instances to be highly mineralized with gold in the contact zone, the mineralization becoming more attenuated as the distance from the gold lode increased. It seems that if the primary enrichment does, in fact, come from the quartz, the gold has been leached away. It is for the purpose of verifying this theory that the present studies are being undertaken. It seems possible, in fact, that a significant tonnage of mineralized prasenites may exist.

The Kandi Iron Ore Deposit

A team sent by BUMIFOM had estimated that the Kandi deposit could be assessed on superficial evidence at 500,000 tonnes of ore (plus 1,000,000 tonnes of probable reserves),

the ore being of fairly low grade averaging between 35 and 50 per cent fe. The mineral was identified as goethite. Laboratory-scale studies of samples in the Institut de Recherches de la Siderurgie in Paris indicated considerable difficulties in attempts to concentrate the crude mineral. The latter problem is naturally of the greatest importance, since the deposit in question is over 700 kms. from the sea, and transportation costs for such a heavy material would thus be heavy.

A more systematic sampling programme, on a very much larger scale, will be undertaken in 1960 to enable a more accurate assessment of this project to be made.

Exploration for oil

Within the framework of the general investigation of the sedimentary basins of the former French West Africa, the Bureau de Recherches de Pétrole (B.R.P.) decided in January, 1959, to carry out a seismic survey along the coast of Dahomey.

The execution of this project was entrusted to the Société Africaine des Pétroles (S.A.), and affiliate of B.R.P., whose head office is at Dakar. The S.A.P. signed a contract with Seismograph Service Ltd., a British company with its head office in London. S.S.L. placed at their disposal the specially equipped ship Seileim, which had already carried out work for the S.A.P. in the Ivory Coast and for Shell-BP in Nigeria. The survey operations consisted of two profiles at sea, parallel to the shore, the nearer one being situated about 2 kms. distant from the coast. The results should give some indications as to the form of the crystalline basement.

Two Canadian companies interested in investment in under-developed countries and in oil exploration have formed the Société des Pétroles du Dahomey (SOPEDA). These companies are Consolidated Denison Mines Ltd., of Toronto, owners of one of the world's most important uranium mines, and Trans-Canada Explorations Ltd., an affiliated company of Denison specializing in oil exploration. Last year SOPEDA obtained its exploration licence and prospecting operations are expected to start immediately.

Other Exploration Projects

A drilling programme is being carried out in the Bontomo region, where outcrops of chromite exist. So far only one important lens of serpentine has come to light. Magnetic and gravimetric surveys are to be undertaken in order to delineate the deposit if it exists.

Two geological research teams were operating in Dahomey during 1959, one studying the alluvial deposits of Alibory and Sota and the other concentrating its attention on the pegmatites with a view to the uncovering of berylliferous pegmatites (in the region to the west of Tachatchou on the Okpara), which will be prospected in 1960.

Ten-Year Plan

A ten-year plan for the advancement of Dahomey was set up last year. It foresees a general airborne geophysical survey for the detection of anomalies, which would be followed by ground work with gravimetric instruments, magnetometers, scintillometers, etc., and finally by detailed drilling programmes. The cost of this programme is expected to be in the region of 750,000,000 frs. CFA and Dahomey will be obliged to apply for financial assistance to such national organizations as the Fonds d'Aide et de Coopération (FAC) or to international bodies such as the Fonds Européen d'Investissement, or simply to private enterprise. This work is regarded as absolutely indispensable to obtain definite information as to the mining possibilities which lie beneath Dahomey's soil.

MINING MISCELLANY

This year is to see the production of Yugoslav coal mines reach over 22,500,000 tons, nearly 1,500,000 tons more than last year. Capital works are reported as started that will enable annual production to reach 28,000,000 tons in a few years. The long term aim is 70,000,000 annually.

Talks started in New Delhi recently between the Japanese steel mission and officials of the Indian Union Ministry of Commerce and Industry for the supply of 4,000,000 tons per year of iron ore to Japan by India for a 10-year period as from 1964. The supply of this quantity of ore involves the development of iron ore mines, the construction of about 300 miles of railway line and the development of port facilities at Vishakapatnam. Japan will give a loan towards this development, which will be adjusted against the supply of ores.

In its resolution after the recent plenary session, the Central Committee of the Bulgarian Communist Party stressed the need to accelerate the rate of advance in production in order to achieve the targets for 1965. These targets include raising coal output to 35,000,000—38,000,000 tons (70 per cent from opencast workings), and stressed the urgency of surveying new mineral deposits, including petroleum and semi-precious metals. Preparation of a 1:25,000 geological map of the country should be considered, said the resolution.

A technical mission from Federal Germany has advised the Peruvian Government to erect a refinery for the production of lead and zinc in Peru. According to the plan recommended, such a refinery would involve the investment of some U.S.\$47,000,000. The plant would have a processing capacity of 150 tonnes of each metal per day. Export by Peru of finished metals instead of ores would increase the country's export earnings by U.S.\$20,000,000—or 6 per cent—per year.

Under an agreement for mutual trade between Japan and Russia for the period 1960-1962 recently signed in Tokyo, Russia is to supply Japan with manganese ore, chrome ore, apatite concentrate, potassium salts, hard coal, crude oil, oil products, machinery and other items while receiving from Japan plant and finished steel.

During 1959, a total of 157,000 tonnes of brown coal and semi-hard coal was produced in Yugoslavia. This is about 10 per cent more than in the previous year. The country's main producers are stated in a bulletin from Belgrade to be the Rasa site for small coal grades and the Trbovje and Zagorje workings for brown coal.

According to a report prepared by the Korean Iron Mining Co., an intensive series of test drills have shown that deposits at the Yangkang mine, at present the principal source of iron ore in Korea, totalled at the beginning of October, 1959, 3,123,000 tons. Only 60 per cent of these deposits are exploitable, and with an annual production of 180,000 tons, the mine is estimated to have a life of 10 years only. An aerial survey of iron ore deposits over 12,000 sq. miles of the country in the centre and East zones, was completed in July last year.

The possible development of a deposit of salts containing potash is reported from Tunisia. The site is near Zarzis. The deposit is estimated at about 1,000,000,000 tons.

The Argentine coal mining company YCF, a body owned by the country's government, has dropped its plan to increase coal production in the Rio Turbio fields to 2,000,000 tonnes annually by 1964. The Rio Turbio coal deposits are the only ones of any size in the country. The competition of natural gas as a means of power, the poor quality of the coal which would stop it from finding a big customer in the new steel industry, and the conversion to diesel-electric operation of the railways which could have become a good customer, are all instrumental in the decision to drop the development plan which would have cost up to U.S.\$42,000,000 to put through. It is now expected that only about 1,000,000 tonnes—three to four times present output—will be produced by 1964. A revision of the contract by which the French company Cie. Industrielle et Agricole de Vente à l'Etranger was to help the financial backing of the scheme is expected to follow the present YCF visit to Paris.

The lead-zinc plant being built with Russian assistance at Plovdiv, Bulgaria, will produce zinc from next year and lead as from 1962.

Having worked its way down more than 560 ft. below the original level of Black Lake, Quebec, the \$2,700,000 dredge *Fleur de Lis* has been put up on stilts on the former lake bottom. What was once a 500-acre lake is now an open-pit asbestos mine, capable of producing 100,000 tons of fibre annually. The mine, and adjacent mill, are operated by Lake Asbestos of Quebec, Ltd., a wholly-owned subsidiary of American Smelting and Refining Co. During its more than 51 months of continuous operation, the *Fleur de Lis* pumped a total of more than 75,000,000,000 gal. of water at a rate of 45,000 g.p.m. In addition, the dredge removed over 31,029,000 cu. ft. of silt and overburden to uncover the asbestos deposit. Operations were continued year-round, with two tugs serving as ice-breakers during the harsh Quebec winters to keep the project moving on schedule. The mine began producing in October of 1958 with the dredge still pumping out the lake bottom. Asarco will keep the *Fleur de Lis* temporarily at Black Lake on a standby basis. Illustration shows the dredge resting on blocks at the lake bottom. Behind, rise the mine benches



Among international congresses of particular interest to the mining industry to be held in the current year are that of the Geological Association of East Germany, to be held in East Berlin from May 10 to 15, the International Potash Congress to be arranged by the International Potash Institute in Amsterdam in July, the International Geological Congress in Copenhagen in September.

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Japanese iron ore importers are interested in the exploitation of Taranaki iron-sands in New Zealand for the extraction of magnetite, and discussions have taken place with the New Zealand Government and Iron Ore New Zealand, the new company formed to extract these deposits. The New Zealand company plans to set up a pilot plant this summer, and envisages an ultimate output of 300,000 tons a year.

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It is reported from Panama that the President signed a contract recently with CANA, the Darien mining company, for the export of gold alluvion from the Darien rivers. Mining operations for manganese have, however, ceased temporarily.

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The World Bank is to lend Mauritania \$66,000,000 by means of a loan to the S.A. de Mines de Fer de Mauritanie, for an iron ore project. The firm is owned as to 27 per cent by a French Government agency, 20 per cent by private French financial interests, and the rest by other European iron ore consumers. France and Mauritania's governments have guaranteed the loan. This \$190,000,000 project to develop open pit iron ore reserves on the fringes of the Sahara Desert, is at a planned annual capacity rate of 6,000,000 tonnes. Mining is expected to start within two years; a 415-mile railway from Fort Gouraud, near the mines, to Port Etienne, and port facilities are also planned. Terms of the 15-year loan call for 6½ per cent annual interest with repayment to begin in January 1966.

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It is announced from Amsterdam that £1,710,000 of the total of £1,950,000 granted by the European Development fund for research schemes on New Guinea is to be spent on geological exploration.

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£20,000 has been approved for geochemical investigation of the mineral potentialities of Sierra Leone. The project was submitted by the Geochemical Prospecting Research Centre of the Imperial College of London, and provides for four separate prospecting research visits over a period of four years.

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Mr. Kaoru Hayashi, Japanese ambassador to Malaya, said in a Press interview in Kuala Lumpur recently Japan's current iron ore requirements were from 10-15,000,000 tons annually. In 1959, Malaya supplied Japan with 3,700,000 tons, compared with 1,800,000 tons supplied by India. India now has an agreement to supply 4,000,000 tons to Japan annually for 15 years, but Mr. Hayashi assured Malaya that this would not jeopardise Malayan exports to Japan. Japan's total iron imports in 1960 are estimated to be 11,700,000 tons, an increase of 1,500,000 over 1959.

The Dominion Bureau of Statistics reports that 1,051,000 tons of asbestos were produced in Canada in 1959 compared with 925,331 tons in 1958.

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Soviet plant worth some 75,000,000 rupees is to be supplied to the new Indian mining machinery factory to be set up at Durgapur. The production capacity of the plant will be some 30,000 tons of mining equipment annually.

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Egypt plans to increase her pit iron and raw steel capacity using domestic iron ore reserves to satisfy her own ferrous metals processing industries, and the Five-year Plan Organization of the U.A.R. has signed an agreement with Salzgitter Industriebau of Western Germany, to advise on all questions of ore production and iron and steel manufacture during that period. A study is first planned of Egypt's raw materials and existing iron and steel plants as a basis for expansion. This is the third contract with Salzgitters to aid Egyptian industries, the previous agreements concerning building-up of a ceramics industry in Egypt, and starting her aluminium production.

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According to recent figures, about 30,000 tonnes of refined aluminium was produced in China during 1959, compared with only 20,000 tonnes in 1958.

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The new San Cataldo potash plant of the Italian Montecatini firm, situated in the Serradifalco district of Sicily, has started production. The mine consists of two 400 m. deep pits, 15 Km. of workings and a processing plant. The raw materials will be taken by cable railways to Campofranco for further processing. Daily production will be 3,000 tonnes, of which some will be worked into synthetic fertilisers at the nearby plant of Porto Empedocle, and the rest exported.

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The Ontario Department of Mines announces the release of four new geological maps, covering the following areas: 1, Ground geophysical map of Balmoral township in the Red Lake district; 2, Preliminary geological map of Nairn and Lorne townships in the District of Sudbury; 3, preliminary geological map of Porter and Baldwin townships in the District of Sudbury. These maps are available at a price of one dollar each. A fourth map, Geological Map 1960, available without charge, covers Methuen township in Peterborough county, and was prepared as part of the Department's programme of examination of industrial mineral deposits. The area includes the Blue Mountain, where a large part of the world's supply of nepheline syenite is produced.

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A new company, Société de Concentration de Minéraux Fluorés (Comifluor), with an investment of 10,000,000 New Francs, has been formed in France by the French metallurgical-chemical concerns Denain-Anzin, Péchiney and Ugine for the exploitation of major fluorspar deposits near Prades, in the South of France. A processing plant will be built on the extraction site with an annual capacity of 35,000 tonnes.



Railroad cars are dwarfed in this artist's conception of a new super-size stripping shovel now being built for Peabody Coal Co., St. Louis, United States, by Bucyrus-Erie Co. Expected to be in operation in 1962, it will be over twice the size of any power excavator ever built. The excavator will weigh 14,000,000 lb. and will provide 12,200 h.p. Present plans call for a 115-cu. yd. dipper. The overburden removed by the shovel in one month could fill all the cars in a train stretching from Pittsburgh to Chicago

Hungary is to start experimental production of germanium in an extractive process from tar and gas liquor. The germanium has been found in the coal deposits at Birsod, and elsewhere, in relatively large quantities, and will go mainly to the semi-conductor industry.

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New pitchblende deposits have been discovered in the Pororari Valley, New Zealand, between Greymouth and Westport on the west coast of South Island. Apart from the Buller Gorge uranium ores, these are the first deposits of the kind in New Zealand. Uranium Valley Ltd. are concessionaires for the area.

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Increased demand for calcium fluoride is resulting in Aluminum Ltd.'s fluorspar mine raising its annual production capacity to 110,000 tons from 75,000. St. Lawrence Co. hopes for increased American sales, despite competition from Mexico. A third mine will be reopened in 1960 in the fluorspar area on Newfoundland's west coast, which has Canada's largest ore reserves.

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British Nylon Spinners, Ltd., are holding their first industrial convention at Park Lane House, London, on May 25-26. Technical papers will be given on subjects of general interest, and an exhibition of nylon articles used is to be arranged.

The Electronics and Nuclear Metals in 1959

The U.S. caesium and rubidium industry remained small, but with auspicious prospects in 1959, reports the Bureau of Mines, Department of the Interior. Production of both metals and their compounds and the consumption of caesium and rubidium products in research and development programmes continued to expand, as also did usage in established applications.

At Los Alamos, a caesium thermionic cell was used in the first direct conversion of nuclear energy into electric power. The device was a plasma thermocouple consisting of a uranium fuel rod surrounded by ionized caesium gas. The caesium plasma proved to have a thermoelectric efficiency much higher than that of any solid bimetallic thermocouple. Interest in caesium-fuelled ion rocket engines continued to increase as several additional firms constructed experimental engines. Rubidium as a working fluid in nuclear power systems, caesium hydroxide in storage batteries, and caesium perchlorate in rocket fuels, gained increased attention.

Caesium metal during 1959 was £540 a lb. and higher. Rubidium metal was £390 a lb. and higher.

Mr. Donald E. Eilertson, Commodity Specialist of the U.S. Bureau of Mines, reports increased interest for high-purity beryllium and beryllium oxide for special nuclear uses; for high-purity beryllium oxide in electronics; for beryllium-copper strip as spring material for electronics, automotive applications, electrical appliances, and business machines; and for beryllium oxide, beryllium intermetallic compounds, and other beryllium-containing materials for high-temperature applications.

The outlook for the electronic metals, gallium and indium, in 1960 is described as encouraging. Gallium arsenide and gallium phosphide, which have interesting properties for uses in electronics, received increased attention from research organizations and some devices made from these semi-conductors are likely to go into production in 1960. The Bureau of Mines Petroleum Research Centre at Bartlesville, Oklahoma, developed a tantalum-lined container that withstands the corrosive action of gallium, permitting this metal to be used in place of quicksilver in making more accurate pressure, volume, temperature measurements. Gallium 99.99 per cent

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pure was available at \$2.50 a gram in 50-100 gram quantities. For similar quantities of electronic-grade gallium, 99.9999 per cent pure, the price was \$3.25 per gram.

Indium continued to be used in semiconductor devices to modify the electronic properties of germanium, in bearings to increase strength and corrosion resistance, and in low melting alloys. Semi-conductor indium, 99.999 per cent pure, was available last year at \$3.75 a troy oz. for 50-99 troy oz.

Rhenium was used in filaments in mass spectrographs and ion gauges, tungsten-rhenium thermocouple elements, and in research for new applications.

The American Smelting and Refining Co., sole U.S. producer of thallium, reported that some research work was done on high-purity thallium for new applications in the electronics industry. Thallium sulphate continued to be the principal product. The 1959 price of thallium metal ranged from \$10 to \$7.50 a lb. depending on quantity. Thallium, 99.999 per cent pure, was available at higher prices.

U.S. domestic production and consumption of high-purity silicon last year have been estimated by the Bureau of Mines as one-half greater than in 1958. New developments, both economic and technological, caused more producers to join the rapidly expanding silicon industry. Estimated production of high-purity silicon was 80,000 lb. of the top three grades and 20,000 lb. of the solar-grade type. Consumption of high-purity silicon was about 70,000 lb., valued at \$18,000,000, including an estimated \$1,000,000 for solar-battery grade silicon. For the three higher grades, approximately 6,000,000 transistors and 60,000,000 diodes and rectifiers were fabricated.

Several technological trends appeared last year that may change the total weight as well as the relative amounts of the three grades of high-purity silicon produced. Fabricators have developed techniques of building as many as three electronic functions into one device, apparently saving material as well as space. Manufacturers of semiconductor devices also appear to be making more economical use of grades 2 and 3 material by using improved "doping" procedures and better device designs.

A 15 per cent reduction in the price of capacitor grade tantalum powder was announced in January by a Pennsylvania firm. This material is used in the production of tantalum capacitors which are widely employed by the electronics industry in missiles, miniaturized communications systems, computers and aircraft. It is hoped that this price reduction, the first in five years, will greatly expand the capacitor market.

The Zirconium Association (2130 Keith Bldg., Cleveland 15), has been formed by U.S. producers and fabricators of zirconium. One of the aims of the new group is to promote non-government markets for this metal.

SOVIET TRADE AGREEMENTS

Metals and minerals are the subject of two agreements recently concluded by the Soviet Union. An agreement with West Germany provides for the following Russian exports to that country

LONDON METAL AND ORE PRICES, MARCH 24, 1960

METAL PRICES

Aluminium, 99.5% £186 per ton	
Antimony—	
English (99%) delivered, 10 cwt. and over £190 per ton	
Arsenic, £400 per ton	
Bismuth (min. 1 ton lots) 16s. lb. nom.	
Cadmium 10s. 6d. lb.	
Cerium (99%) net, £16 0s. lb. delivered U.K.	
Chromium, Cr 99% 6s. 11d./7s. 4d. lb.	
Cobalt, 12s. lb.	
Germanium, 99.99% Ge. kilo lots 2s. 5d. per gram	
Gold, 24s. 11d.	
Iridium, £23/£25 oz. nom.	
Lanthanum (98%/99%) 15s. per gram.	
Manganese Metal (96%/98%) £275/£285	
Magnesium, 2s. 24d./2s. 3d. lb.	
Nickel, 99.5% (home trade) £600 per ton	
Osmium, £22/£24 oz. nom.	
Osmiridium, nom.	
Palladium, Imported, £8 12s. 6d.	
Platinum U.K. and Empire Refined £30 5s.	
Imported £28/284	
Quicksilver, £70s./£71 ex-warehouse	
Rhodium, £45/£48 oz.	
Ruthenium, £16/£18 oz. nom.	
Selenium, 5s. 0d. per lb.	
Silver, 79d. f. oz. spot and 78 1/2d. f'd	
Tellurium, 21s. 6d. lb.	

ORES AND OXIDES

Antimony Ore (60%) basis	..	..	..	..	..	19s. 6d./21s. 6d. per unit, c.i.f.
Beryl (min. 10 per cent BeO)	..	..	..	..	..	230s. per l. ton unit BeO
Bismuth	..	..	..	..	..	30% 5s. 0d. lb. c.i.f.
Chrome Ore—						20% 3s. 3d. lb. c.i.f.
Rhodesian Metallurgical (semifriable 48%) (Ratio 3 : 1)	..	..	..	..	..	£12 15s. 0d. per ton c.i.f.
" Hard Lumpy 45%	..	..	..	..	..	£15 10s. 0d. per ton c.i.f.
" Refractory 40%	..	..	..	..	..	£11 0s. 0d. per ton c.i.f.
" Smalls 44%	..	..	..	..	..	£14 0s. 0d. per ton c.i.f.
Baluchistan 48% (Ratio 3 : 1)	..	..	..	..	..	£11 15s. 0d. per ton f.o.b.
Columbite, Nigerian quality, basis 70% combined pentoxides (Ratio 10 : 1) $\text{Nb}_2\text{O}_5 : \text{Ta}_2\text{O}_5$	..	..	..	..	..	175s. per l. ton unit c.i.f.
Fluorspar—						
Acid Grade, Flotated Material	..	..	..	..	..	£22 13s. 3d. per ton ex. works
Metallurgical (75/80% CaF_2)	..	..	..	..	..	156s. 0d. ex. works
Lithium Ore—						
Petalite min. 3 1/2% Li_2O}	..	..	..	..	..	47s. 6d./52s. 0d. per unit f.o.b. Beira
Lepidolite min. 3 1/2% Li_2O}	..	..	..	..	..	47s. 6d./52s. 0d. per unit f.o.b. Beira
Amblygonite basis 7% Li_2O}	..	..	..	..	..	75s./85s. per ton f.o.b. Beira
Magnesite, ground calcined	..	..	..	..	..	£22 0s./£30 0s. d/d
Magnesite Raw (ground)	..	..	..	..	..	£21 0s./£23 0s. d/d
Manganese Ore Indian						
Europe (46%-48%) basis 67s. 6d. freight	..	..	..	..	..	73d./75d. c.i.f. nom.
Manganese Ore (43 1/2%-45%)	..	..	..	..	..	69d./71d. c.i.f. nom.
Manganese Ore (38 1/2%-40%)	..	..	..	..	..	8s. 11d. per lb. (f.o.b.)
Molybdenite (85%) basis	..	..	..	..	..	£28 0s. Od. per ton c.i.f. Aust'n.
Titanium Ore—						
Rutile 95/97% TiO_2 (prompt delivery)	..	..	..	..	..	£11 10s. per ton c.i.f. Malaya
Ilmenite 50/52% TiO_2	..	..	..	..	..	148s./152s. per unit c.i.f.
Wolfram and Scheelite (65%)	..	..	..	..	..
Vanadium—						
Fused oxide 95% V_2O_5	..	..	..	..	..	8s. 0d. 11d. per lb. V_2O_5 c.i.f.
Zircon Sand (Australian) 65-66% ZrO_2	..	..	..	..	..	£16/£16 10s. ton c.i.f.

ESTIMATED EXPORTS U.S.S.R. TO JAPAN

		1960	1961	1962
Manganese ore (tons)	...	10,000	10,000	10,000
Chrome ore (tons)	...	20,000	25,000	30,000
Platinum (kilos)	...	800	900	1,000
Palladium (kilos)	...	600	700	800

during 1960 (last year's figures in parenthesis):

Pyrites 100,000 tons (140,000); manganese ore 80,000 tons (100,000); chrome ore 70,000 tons or possibly more (45,000), crude iron 75,000 tons (unchanged); ferrochrome 2,500 tons (unchanged); wolfram concentrates 1,500 tons (1,200); zinc 6,000 tons (4,000), tin 1,500 tons or possibly more (3,000); antimony 2,000 tons (1,500), platinum 1,500 kilos (unchanged) and palladium 900 kilos (unchanged).

Estimated exports from the U.S.S.R. to Japan during the next three years, under a new agreement, are shown.

Figures for the second and third years are subject to review.

ALUMINIUM PRODUCTION RISES

Alcan has announced that \$1,630,000 will be invested at its Kitimat, British Columbia, smelter for furnaces and other equipment to provide aluminium

fabrikators at home and abroad with increased tonnages of extrusion ingot. The new equipment is to be in operation by the end of 1960 and will enable the plant to produce some 36,000 tons of extrusion ingot annually out of its present rated capacity of 186,000 tons of primary aluminium.

Alcan also plans to spend \$2,000,000 on plant improvements at its Arvida, Quebec, smelter. The programme will include installation of two new furnaces for the treatment of aluminium metal and two giant saws for cutting ingots. The new equipment will improve Alcan's ability to meet demand for specific shapes of aluminium.

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The Anaconda Aluminium Co. a subsidiary of Anaconda, has announced that aluminium production at its plant at Columbia Falls, Montana, is to be increased to 100 per cent of capacity this summer, or roughly 60,000 tons a year, from the present rate of 52,500 tons a year, or 87.5 per cent.

COPPER • TIN • LEAD • ZINC

(From Our London Metal Exchange Correspondent)

The firmer undertone continues in the lead and zinc markets, but there is some hesitancy in both the copper and tin markets, and in the case of copper the backwardation has increased considerably.

COPPER LOOKS STEADY IN SHORT TERM

Consumer demand in the U.K. and in Europe has continued at a satisfactory level. Reports from the U.S. indicate that the brass trade is not doing as well as expected, and the copper fabricating industry is experiencing appreciable competition from abroad and therefore offtake is not as great as many hoped. Producers report that their supplies of April copper are almost all sold but customs smelters still have metal available and dealers have been unable to sell even at a discount below the 33-c. level.

In London, turnover on the L.M.E. has not been as great as in recent weeks, and the backwardation has increased considerably in view of the drop in stocks in official warehouses by 525 tons to a total of 2,372 tons. It is believed that the demand for nearby copper will continue at least until Easter and no appreciable decline in the price level is expected.

In Chile there has been a 24-hour strike of workers at the main copper mines as part of a general stoppage called by the Central Trade Union. This

may indicate the difficulties in reaching a settlement when the present labour contracts expire at La Africana on March 2 and Salvador on April 30. In the Belgian Congo the political unrest appears to have subsided but all observers agree further trouble cannot be avoided in view of the coming independence of the country.

The Copper Institute's figures for February showed that production of refined copper in the U.S. increased to 105,417 tons as against 86,491 tons in January and at the same time domestic deliveries rose by nearly 10,000 tons and stocks of refined copper at the end of February stood at 64,007 tons against a revised figure for the end of January of 68,550 tons. Outside the U.S., production in February amounted to 164,535 tons as compared with a revised figure of 171,123 tons in January, whilst deliveries to fabricators remained almost unchanged, stocks rose slightly to 238,344 tons as compared with a revised figure of 235,488 tons at the end of January.

BUFFER STOCK MANAGER LESS ACTIVE

The tin market has continued featureless with operations by the buffer stock manager apparently very much smaller than in past weeks. The price level has shown a slight decline owing to lessening consumer interest and the continuance of above average tonnages being offered daily in Singapore. Stocks in official

warehouses fell by 98 tons to 7,900 tons at the beginning of the week.

On Thursday the Eastern price was equivalent to £793½ per ton c.i.f. Europe.

L.M.E. LEAD-ZINC PRICES UP

The lead and zinc markets have been slightly more active than of late with a rise in the price level of both metals. Demand in the U.K. and Europe remains good, but some reports speak of dissatisfaction with the rate of offtake in the U.S.

The future of the zinc price in the U.S. is also subject to doubt as car dealers hold more than 1,000,000 unsold vehicles which may result in the production of the 1960 models being discontinued earlier than usual. In spite of this, officials of the St. Joseph Lead Co. have said that they expect an increase of about 10 per cent in the consumption of both lead and zinc in 1960 as compared with 1959.

CHANGE IN BASIS OF L.M.E. LEAD-ZINC DEALINGS

In London there has been a meeting of subscribers of the London Metal Exchange at which it was decided to alter the basis of dealings in the two metals so as to conform to those for copper and tin, that is to say, to delivery on a warrant basis with daily settlement. It is understood the committee will now finalize draft contracts which have already been prepared on this basis, and will then announce the date on which the change will take place, but in view of long-term contracts, a lengthy period of notice will probably be necessary.

The British Bureau of Non-ferrous Metals Statistics has issued figures for January (December figures in parenthesis) which give the consumption of copper as 57,316 tons (59,246 tons) with end of month stocks amounting to 61,088 tons (55,005 tons). Lead consumption was 31,745 tons (13,772 tons) and end of month stocks totalled 44,290 tons (48,035 tons). Oftake of zinc totalled 30,637 tons (30,829 tons) whilst end of month stocks totalled 48,337 tons (37,162 tons). Usage of zinc amounted to 1,878 tons (1,997 tons) and end of month stocks amounted to 10,884 tons (11,523 tons).

Closing prices are as follows:

	March 17 Buyers Sellers	March 24 Buyers Sellers
COPPER		
Cash ..	£250	£251
Three months ..	£235½	£236
Settlement ..	£251	£254
Week's turnover	10,750 tons	9,700 tons
LEAD		
Current ½ month	£76½	£76½
Three months ..	£75½	£75½
Settlement ..	£76	£76½
Week's turnover	5,700 tons	12,900 tons
TIN		
Cash ..	£791	£791½
Three months ..	£790	£790½
Settlement ..	£791½	£786½
Week's turnover	795 tons	740 tons
ZINC		
Current ½ month	£89½	£89½
Three months ..	£88	£88½
Settlement ..	£91½	£91½
Week's turnover	5,275 tons	5,225 tons

Mining Finance

Good Things Ahead for Petaling?

The year to October next should prove to be most satisfactory for Petaling Tin. Since 1955, operations have been bedevilled by difficulties of one kind or another. Quite apart from the effects of output restriction and of contributions to the buffer stock, Petaling has had to face a major river diversion project and rehabilitation of its number 4 dredge. To make matters worse, these difficulties coincided with disappointing results from the company's No. 5 dredge.

This dredge had been moved—at no small expense—to the company's seaport area, but conditions proved unsatisfactory, and operations in the area had to be abandoned. Just to add to Petaling's troubles, the No. 6 dredge, the company's largest and most economical unit, was operating in previously dredged ground and returning only a low rate of output.

For the current year, however, prospects are very much brighter. The river deviation is complete, No. 6 dredge is now working in virgin ground, and although it may prove impossible to work Nos. 3 and 4 dredges while output restriction remains in force, the big No. 6 unit is capable of producing tin at a comparatively low cost. In addition, the company's finances have now been restored to something like the strength they had before 1956, with the cost of the river deviation fully paid.

One adverse factor, however, is singled out for mention by Mr. D. C. Thomson, chairman of Petaling, in his annual statement. This is the newly imposed import tax on diesel and fuel oils. This is extremely high, and reports from Malaya indicate that some producers which were considering reopening after Restriction shut-downs are having second thoughts. In fact, there may be cases where mines still in operation may be forced to close.

This new levy seems oddly at variance with Malaya's generally enlightened outlook towards foreign capital, especially since it comes so soon after the government's generous concessions to "pioneer industries". It would be a pity if the encouragement given to pioneer industries is denied to the established ones, like tin, upon which the Federation is so dependent.

KONONGO—MR. ANNAN'S WARNING

At Tuesday's annual meeting of Konongo Gold Mines, Mr. Robert Annan, the chairman, reminded shareholders that the future of the mine depends on the discovery of substantial new sources of ore, and that after twenty-four years of productive life, the areas remaining for testing are steadily diminishing.

Meanwhile, the grade of ore treated by Konongo's 7,000 t.p.m. capacity mill continues to decline and profits remain on a slowly falling curve. In the first five months of the current year, an average of 6,766 tons have been treated at an average grade of 10.7 dwt. for an operating profit of about £10,000 per month; in the previous full year, throughput averaged almost 300 tons less, but monthly profits were more than £4,000 higher as a result of the substantially higher grade treated.

This slow but steady deterioration in the position can be expected to continue,

failing new major ore discoveries. Partly is this a function of the declining value of ore reserves themselves, but more important is the fact that an increasing proportion of mill tonnage is being derived from sources other than reserves. This in turn is caused by two factors: first, the increased amounts of development ore coming forward as a result of the accelerated development programme; and second, a deliberate policy decision to conserve the reserves to provide more time for the examination of new areas.

RECORD YEAR FOR HOMESTAKE

Homestake Mining Company, who own the biggest gold mine in North America, last year achieved their highest rate of production since the mine opened in the 1870's. Throughput totalled 1,746,244 tons, and a slightly higher grade resulted in the production of 573,384 oz. This in turn enabled net income to rise by \$300,000 to \$4,415,569, equivalent to \$2.20 per common share.

At the end of 1960, ore reserves at the Homestake mine totalled 13,871,700 tons at an average grade of \$12.40, or about 7.5 dwt. per ton. This tonnage is, of course, not comparable with tonnages announced by South African mines, since under American practice, reserves often include ore which would elsewhere be described as "probable", or even "possible".

WORK RESTARTS ON MISIMA

According to a report from Sydney, operations on the Misima prospect of Pacific Island Mines began on December 1 last. Pacific Island was floated just over a year ago to exploit the sulphide zones which lie beneath the oxidic zones so successfully developed by Cuthbert's Misima Mines in the late 1930's. Although the Cuthbert fortunes were founded on gold, Pacific Island believes that below the ground water level, lead, zinc, and silver values exist in association with the gold.

In the period December 1 to February 29, Pacific Island has completed some 12,200 feet of systematic trenching covering some 60 acres, and detailed testing to delineate lode structure is now in progress. Elsewhere in the company's 22-square-mile exclusive prospecting area on Misima, intensive prospecting has indicated the presence of an entirely new lode system carrying promising gold values.

Although an accurate estimate of tonnage and grade cannot yet be determined, the company says that results to date have indicated that prospects for establishing an economic operation are "very favourable". The consulting engineer has recommended that a pilot plant be installed to accurately evaluate the deposits, and this is now under consideration by the board of directors.

Misima's potential as a seat of mining operations is promising. The island has an abundance of good timber and water supplies are more than adequate. Above all, the Papua-New Guinea administration, which controls the island, has recently reduced its royalty rate to 1½ per cent and offered other encouragements to gold production.

PROGRESS AT CAMP BIRD, COLORADO

According to a report from Denver, construction of a new 500 ton-per-day concentrating mill at the Camp Bird mine near Silverton, Colorado, is due to begin immediately. Completion of the mill is scheduled for September 15.

Last year's Camp Bird annual report stated that 12,294 tons of ore had been broken and stockpiled by the end of October last year. The ore is complex and contains gold and copper in addition to the lead, zinc and silver which are the primary products. The mill has been specially designed to treat the Camp Bird ore, and it is hoped that some recovery of the by-product metals will prove possible.

At present, a mine crew of about 50 men is working at the mine, with the primary object of opening enough shrinkage stopes to ensure uninterrupted supplies of feed for the mill. Rapid expansion of mine production is planned, and it is hoped that capacity milling will be achieved very soon after the plant is commissioned.

WESTERN DEEP PASSES A MILESTONE

A milestone was passed by Western Deep Levels last week, when the mine's No. 2 Main shaft intersected the Ventersdorp Contact Reef at a depth of 5,599 feet. Sampling round the perimeter of the shaft showed 80 feet of reef at an average value of 7.6 dwt. over a width of 41.5 inches, equivalent to 315 in. dwt. The remaining 10 feet of reef was incompletely exposed because of faulting.

This result is roughly in line with the values on the V.C.R. discussed in development within the Western Deep area from headings put across the boundary from West Driefontein. Up to the end of February, 1,440 feet of development had been done in this way. Sampling had totalled 665 feet, of which only 7.5 per cent had proved payable at an average value of 367 in. dwt.

Milling of V.C.R. ore at Western Deep is due to begin in 1962.

CHARTERED'S NEW INVESTMENTS

At last week's annual meeting of the British South Africa Company, Lord Robins, the president, gave details of some of the changes which have taken place in Chartered's portfolio.

The total book value of the company's investments at March 9, he revealed, was £43,700,000, made up of £28,300,000 quoted investments and £15,400,000 unquoted. At the same date, the market value of the quoted investments was about £40,000,000, while the unquoted holdings showed an estimated appreciation over book value of not less than £5,000,000.

Chartered's recent participation in the formation of Locana Minerals was, it now appears, only one aspect of the company's diversification in Canadian holdings. Lord Robins said that future opportunities for long term investment in Canada would not be overlooked. Meanwhile, Chartered has increased its interest in the Hudson's Bay

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Company, and a substantial investment has been made in McIntyre Porcupine Mines. Apart from these new Canadian investments, Chartered has added shares in I.C.I. and some British steel companies to its portfolio.

BARIMA JOINS RIO IN EXPLORATION PROJECT

Barima Minerals, a Toronto-registered company closely connected with the Rio Tinto group, is to join other associated companies in a prospecting programme led by Rio Tinto Exploration. The syndicate is currently exploring in the area north-west of Val d'Or, in Gaspe and in New Brunswick. Investigations are also in progress in areas surrounding a property now being drilled by Rio Tinto which has shown some promise of copper/zinc mineralization.

Barima's main interest is a placer gold property on the Barima River, British Guiana. This is being dredged under a profit sharing plan with Mr. D. Lewes, one of the directors, who discovered the deposit. Barima also has a 51,100 acre bauxite prospect in the Pomeroon area of British Guiana.

DEVELOPMENT RESTARTS AT PATER

Underground development has restarted at the Pater property of Pronto Uranium Mines, following the dewatering of the 1,032 foot three-compartment shaft sunk by the previous owners. In terms of the proposed merger of the Rio Tinto Elliot Lake uranium mining companies, the Pronto mill is to be converted to treat copper ore from Pater. Before its closure in 1957, Pater's reserves were estimated at

a little over 1,000,000 tons at a grade of about 2.1 per cent copper before allowing for dilution.

The development programme at Pater will begin with 300 feet of cross-cutting on the 950-foot level. This will be followed by lateral and raise development, and a deep drilling programme. The next step is limited shaft deepening, which will establish a loading pocket for the present level.

No date has been set for the commencement of ore production, but in a message to Rio employees on the reorganisation scheme, the Hon. Robert Winters said that Pronto would suspend uranium production "within the next few months" to prepare for the conversion of its flowsheet. Ore removed during the development programme will be stockpiled at the Pater headframe.

LONDON MARKET HIGHLIGHTS

After recovering substantially from the shocks of the previous fortnight, South African Gold share prices took a fresh plunge on Monday and Tuesday following the latest outbreaks of racial rioting in South Africa.

But although the fall in prices was severe—ranging up to 15s. in some cases—no heavy selling pressure was reported. Even the renewed offerings of stock from the Continent could hardly be described as "panic selling" and London sales were generally light.

Meanwhile, Johannesburg as always took a much less serious view of things. Prices at that centre were usually higher than in London and by Tuesday buyers began to reappear. On Wednesday, while London was beginning to have second thoughts about the situation, Johannesburg demand revived strongly and a widespread recovery developed.

At the time of writing the recovery seems to be more soundly based than the sharp rebounds that occurred in the previous week. Much of the demand in Johannesburg seems to be coming from the institutions and there are signs that U.S. buyers are also returning. In view of the heavy falls that have occurred this year many shares are somewhat undervalued on technical grounds and now leave the buyer something to go for. But much depends on an easing in the racial tension in Southern Africa.

Another factor which has helped the recovery is the improved power situation at the mines of the O.F.S., Klerksdorp and Far West Rand fields. Although production at Coalbrook is almost nil as a result of the refusal of African miners to go underground, fuel is now reaching Taaibos and Highveld power stations from coalfields to the east. It may still prove necessary to economize on power for some time because of the limited coal moving capacity of South African railways, but it is unlikely that output will henceforward be affected to any significant degree. It may be wondered why Escom, by living from hand to mouth, allowed such a situation to arise. With coal in worldwide surplus it would not seem unreasonable for the power stations to maintain some stock of fuel for the protection of the consumer.

The following table gives some idea of the way in which prices fluctuated last week. Friday's closing levels are compared with the low points reached on Tuesday and the final prices on Wednesday.

	March 18	March 22	March 23
Ang. American	9 1/2	8 1/2	8 1/2
Chartered	94/6	91/3	91/6
De Beers Df.	177/6	161/3xD	165/-xD
Durban Deep	32/6	30/-	30/6
F. S. Geduld	152/6	137/6	147/6
Gold Fields	79/6	72/6	74/-
"Ofsits"	90/3	81/3	85/6
St. Helena	75/6	72/-	72/3
W. Driefontein	177/6	165/-	172/6
W. Holdings	153/9	138/9	147/6

During the setback Rand Mines made no response to a report that the company was on the brink of announcing plans for a new copper mine in Southern Rhodesia. Lorraine, however, were helped by talk of good development values in current quarter's operations. The Union Corporation final dividend of 2s. 9d. making 3s. 9d. compared with the previous year's 3s. 6d. caused little excitement, but the market was impressed by a rise in profits (after tax) from £1,903,957 to £2,856,915.

Copper shares remained a dull market and prices failed to recover even when Kaffirs picked up. Chartered slid back to 91s. 6d.—earlier this year they touched 119s. 6d.—and Messina fell to 116s. 10d. Lead-zincs, however, perked up considerably after some previous dullness. The recent steady improvement in prices of both metals was reflected in a recovery to 70s. 3d. in Consolidated Zinc.

Throughout the period Tins remained the only consistently firm Mining section. Both Singapore and London demand contributed to a steady, if not spectacular, improvement in prices. It was realised that current year's operations should be largely unhampered by output restriction and with a very satisfactory and stable metal price the mines should now be making good profits. Eastern demand centred on Ayer Hitam which climbed 3s. 6d. to 6s. while local buyers came forward for Pahang (10s. 7d.) and Malayan (22s. 3d.).

MINING IN CANADA—See the special supplement in next Wednesday's Overseas Edition of *The Globe and Mail*, Canada's national newspaper. Sixpence from your newsagent.

GEOLOGISTS: DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH. 8 pensionable posts in Geological Survey for men and women aged 21 and under 30 (31 for permanent members of Experimental Officer Class) on 1.7.60; extension for regular Forces Service or Overseas Civil Service. Candidates should normally have (or obtain in 1960) 1st or 2nd class honours degree in Geology. Salary scale (men, London) £655-£1,150. Starting pay may be above minimum. Promotion prospects. Write Civil Service Commission, 17 North Audley Street, London, W.1, for application form, quoting S/168/60. Closing date April 13, 1960.

GEOPHYSICIST: DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH. Pensionable post (graded as Geologist or Senior Geologist) in Geological Survey and Museum, London, for man at least 21 on 1.7.60. Duties are concerned with geophysical surveys in the field. Candidates should normally have (or obtain in 1960) 1st or 2nd Class honours degree in Geology, Geophysics, Physics, or Mathematics, together with a university qualification to at least first year standard in Geology and in Physics or Mathematics, or an equivalent qualification. Experience in Applied Geophysics an advantage. At least 3 years' post graduate or other approved experience necessary for appointment as Senior Geologist. London salary within the scales £655-£1,150 or £1,233-£1,460, according to age, qualifications and experience. Starting pay may be above minima. Promotion prospects. Write Civil Service Commission, 17 North Audley Street, London, W.1, for application form, quoting S/5114/60. Closing date April 13, 1960.

PETALING TIN IMPROVED RESULTS MR. D. C. THOMSON'S STATEMENT

The Thirty-fourth Annual General Meeting of Petaling Tin Limited was held on March 18 in Ipoh. **Mr. D. C. Thomson**, Chairman, presiding.

The following is his statement dated February 3, which had been circulated with the report and accounts for the year ended October 31, 1959:—

Your Chairman, Mr. J. T. Chappel, C.B.E., J.P., resigned from the Board in March, 1959, upon his retirement from Malaya, after a long association with the Company; his co-directors accepted his departure and the loss of his advice, after service in this country extending over thirty years, with regret.

My colleagues on the Board did me the honour of choosing me as his successor, and I much appreciate their confidence.

Results for the year showed a considerable improvement over recent years, the net profit was £693,900 (£80,955) an increase of £483,955 (£56,462) over the previous year.

Due allowance has been made for depreciation and property redemption and Capital expenditure included the balance of the purchase consideration for 176 acres of Pilmoor Estate amounting, with costs, to \$320,566 (£37,399), a further instalment of \$171,429 (£20,000) for the purchase of 595 acres of Castlefield Estate, and the cost of completing the diversion of the Klang River amounting to \$145,142 (£16,933).

The Company's Buffer Stock contributions amounted to \$199,018 (£23,219) making an aggregate contribution of \$874,772 (£102,057).

Consequent upon the improved returns it was considered that the payment of dividends could be resumed as forecast by Mr. J. T. Chappel in last year's Chairman's statement and interim dividends aggregating 20% have been declared.

The bank overdraft account was substantially reduced and the Company's investment holdings remained intact; in common with most dated securities, quoted values improved slightly during the year.

It is anticipated that, providing there is no setback in the tin market, there will be a continuing improvement in results.

Operations

From the General Manager's report it will be seen that No. 6 Dredge operated intermittently, commensurate with quota requirements and the production of permissible stocks under the Tin Control Regulations. No. 4 Dredge operated for a brief period when No. 6 was idle pending the diversion of the Klang River into the newly-constructed channel, in order to free the future course for the latter dredge in virgin ground.

Nos. 3 and 5 Dredges remained on a care and maintenance basis.

Future operations with No. 5 Dredge were under active consideration throughout the year, but it was not possible to arrive at any conclusion; this, however, is still under review in relation to future developments.

In order to avoid the dispersal of an appreciable number of the labour force with only one dredge operating, the greatest number were given employment and tribute must be paid to all for their acceptance of the difficulties and the manner in which they carried out their duties.

Heavy Taxation

The Federal Elections took place in the middle of the year, thus setting the pattern for the next few years. The moderate policies of the successful Alliance Party gave rise generally to more confidence for the future, but the recent Budget gave cause for concern by the imposition of taxes which bear heavily on the Industry; the import tax on fuel oils is particularly severe and could well result in the elimination of some producers. This is a trend which cannot but influence future development and planning, as a stage must be reached when crippling costs will cause abandonment of lower grade deposits and create less inclination to venture capital in mining with its extremely speculative features. It is hoped that the encouragement given to pioneer industries will not be denied the established ones upon which Malaya is so dependent.

Tin Restriction

The operation of the International Tin Agreement was a success, or otherwise, according to the individual point of view but, since the crisis in 1958 when the floor price of £730 could not be maintained and the market price slumped to £640, there has undoubtedly been a steady improvement and world quotas increased progressively each quarter from 20,000 tons at the commencement of the year to 36,000 tons, at the time of writing, in the Ninth Quota Period.

On the basis of the greatest benefit for the common good the vicissitudes of the Control Scheme have caused operators in other commodity fields to hail it as one that works successfully and, also, a satisfactory demonstration of international co-operation. There are still, however, weaknesses, in so far as all producing and consuming countries are not signatories to the Agreement and it is highly desirable that, if a new Agreement is decided upon, those outside its aegis should be induced to identify themselves more closely with it; this, however, would appear to be unlikely of attainment.

Opinions differ according to individual points of view but whilst an unfavourable surplus of production over consumption prevails there is good reason to support the introduction of a new agreement, and it appears that the Federation Government will support this view; providing the disruptive effects of non-signatory production are minimized it would appear that more stable conditions can be assured by a continuance of such regulation of supply to demand.

No. 6 Dredge will be operating in virgin ground for the next few years and, subject to favourable market conditions, returns should be satisfactory. Prospects for the coming year are therefore much more encouraging.

Finally I wish to pay tribute to the Company's staff and labour force at the mine for their continued efficient and loyal service.

The report and accounts were adopted.

KONONGO GOLD MINES

The twenty-sixth annual general meeting of Konongo Gold Mines, Ltd., was held on March 22 in London.

Mr. Robert Annan, M.I.M.M., Chairman, presided, and in the course of his speech, said:

During the period covered by the accounts there was a considerable increase both in the tonnage milled and in the amount of development, but the yield continued the falling trend of the last five years.

The Profit and Loss Account shows available for distribution out of the year's profits a sum of £94,447. The interim dividend of 1½d. absorbed £26,813. Your Directors now recommend a final dividend of 3½d. per share less tax, which will take £62,563 nett.

Coming now to operations at the mine, the milling rate was increased with the object of reducing unit costs in order to offset falling grade of ore and to permit the treatment of marginal ore so as to reduce the drain on our proved reserves.

Every effort is being made by development to find new sources of ore and to maintain the ore-reserves. The results were not as encouraging as we had hoped, but there have been some signs of improvement recently. Development of the No. 2 South ore shoot at Boabedroo was continued during the year, bringing the amount proved on this orebody up to 60,000 tons of ore at 11.8 dwt. Search for its possible extension above No. 4 Level continues. A block of good grade ore is also being proved in the footwall of the main Boabedroo fissure between the 10th and 13th Levels. Its vertical dimensions may be limited but some of the recent work on this has been more encouraging.

Following on geological studies over the past two years, exploration by diamond drilling has been intensified in the search for branch or parallel ore shoots associated with the main fissures. This work is already giving results which are being followed up by development. These deposits are apt to be irregular in occurrence and until they have been opened up no forecast of their importance is possible.

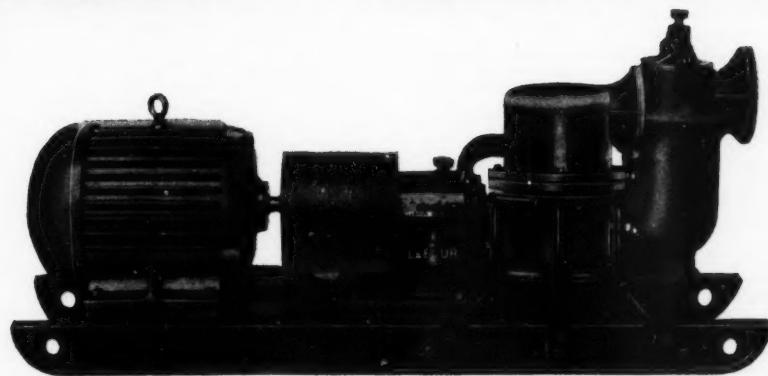
A further examination of the surface by geochemical technique is also being carried out, the first results of which are now undergoing expert review.

Nearly one-third of the tonnage treated is being derived from sources outside the proved reserves. This enables us to prolong the life of the reserves and, consequently, the period in which exploration for further orebodies can be continued. During the first five months of the current financial year the tonnage milled has averaged 6,766 tons yielding 10.7 dwt. a ton for an average monthly profit of £9,770. For the previous full year the comparative figures were 6,492 tons yielding 11.8 dwt. for a profit of £13,415.

With the declining value of the ore reserve which has persisted over the last five years it is evident that our profits must diminish unless substantial new discoveries are made. The prospects for this cannot safely be predicted. We are continuing to find more ore on a limited scale but after twenty-four years of productive operations the areas remaining for testing are steadily diminishing.

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Technical Briefs

Electrostatic Separation of Beach Sand Minerals

Although both the high tension roll type and the various plate type of separators are fairly well known, probably the difference in the principle of operation is not generally appreciated.

In the high-tension separators, the separation depends largely on the pinning effect of the poor conductors to the roll whilst the trajectory of the thrown particles is influenced by the particle size and the specific gravity.

In the case of the plate type or conductance separator the separation is dependent on the magnitude and sign of the charge carried by a particle so that fine material is attracted more readily than coarse. This fact has been clearly shown in a report of an investigation carried out on beach sand minerals by CSIRO (Melbourne Ref.: CSIRO report 575 "Concentration of Beach Sand Minerals from Yoganup, Western Australia", by S. B. Hudson).

Test work showed that a substantial proportion of the leucoxene could not be separated from the non-conductors in a high-tension separator (although a great deal of the ilmenite was removed), because the leucoxene was not sufficiently conducting and was much finer than the coarsest non-conductors.

The moderately conducting minerals such as the leucoxene can be panned readily and the voltage required to pin the coarsest non-conductors (such as quartz and zircon) was sufficient to pin much of the leucoxene.

In the conductance separator, however, this size difference enhanced rather than marred the separation since, although leucoxene acquired only moderate electrical charges, it was readily attracted towards the electrode because of its fineness. Unfortunately, at the same time, the very fine non-conductors were also attracted and it was found necessary to employ high-tension separation to separate the leucoxene from the fine non-conductors since the comparative fineness of the non-conductors is advantageous on the high-tension (roll-type) machine.

In order to obtain relatively clean ilmenite and leucoxene concentrates from the sample under examination by electrostatic means alone, it will be necessary to use high-tension separation to produce a highly conducting concentrate (ilmenite rich), a fairly large middling and a small tailing containing the finest non-conductors whilst conductance separation should be employed to recover the leucoxene from the high-tension middling.

Conductance separation will, therefore, separate a mineral such as leucoxene from the coarse but not the fine non-conductors and high-tension separation has the opposite effect. In the same investigation, magnetic separation was used in the normal way to separate rutile and leucoxene from ilmenite as well as gravity treatment for the recovery of zircon and monazite.

The effect of particle size, and indeed, specific gravity and shape on such separations is very important and the possibility of suitable feed preparation by classification or table treatment producing the so-called "reverse classification" should not be overlooked. This aspect was also noted recently by F. A. Williams in a paper to the Inst.M.M. on the "Use of High-Tension Separation in Dressing Jig Concentrate from Decomposed Columbite-bearing Granite, Nigeria". (—Bull. I.M.M. No. 635.)

RANGE OF FLOCCULANTS

Cyanamid have recently produced an interesting and informative booklet on their flocculants. At the present time this company is marketing four types. Aerofloe 550, of which the active ingredient is hydrolyzed polyacrylonitrile, has replaced 548 and 552 and is said to be widely used. Aerofloe 3000, 3171 and Superfloe 16 are based on a water-soluble polymer, polyacrylamide and although all the flocculants are usually effective in neutral and alkaline suspensions, the polyacrylamide series are more effective than Aerofloe 550 in acid pulps. Aerofloe 3000 has the lowest molecular weight whereas Superfloe 16 possesses the highest molecular weight. Not only are these reagents flocculants, but they and Aerofloe 550 in particular are effective in complexing calcium ions thus preventing deposition of troublesome calcium salts on filter cloth incrustations, etc.

Fields of application, use in conjunction with electrolytes, toxicity, preparation of solutions and methods of feeding reagent consumption, are also discussed and suggestions are made for laboratory methods to be used in testing for both settling and filtration rate.

SERIAL GRAVITY CONCENTRATION

A new proposal for a system of gravity concentration has been put forward by J. H. Harris (Bull. I.M.M. No. 637), in which it is suggested that instead of preparing the feed into more or less narrow size bands by screening or classification before gravity concentration and treating each band parallel, a procedure which the author terms "Serial gravity concentration" should be employed. In this way, suitable gravity concentration steps are applied in series with means of adjusting the size range between each stage. This proposal is the result of observations and a number of experiments carried out in Malaya on the concentration of cassiterite in alluvial deposits and the author produces evidence to show that the losses in jiggling (and, indeed, in Durlang washing) are not only in the very fine sizes but also in a middle range controlled by the relative sizes of the gangue and of the minerals sought and such losses are irrecoverable by any repetition of the process without change of the nature of the feed.

Consequently, the author suggests, and indeed, brings evidence to support his argument, that the most effective method of gravity concentration is that which employs a roughing stage, followed by screening to remove barren oversize, altering the size range of the light mineral followed by one or more scavenging stages which can be adjusted to deal with the new size range.

In this way, the amount of material to be treated at each successive stage becomes progressively less and the overall loss decreases with each stage in almost geometric progression. In such a treatment, which has proved undoubtedly successful on alluvials, the tendency is to employ two cell jigs rather than a greater number formerly preferred.

It has also been suggested that since all gravity concentration operations are similar, the procedure could be applied to other methods. There appears to be no valid argument to support this assumption and it is difficult to visualize either effective or economical screen separation in the finer size ranges sometimes encountered. It is also difficult to see how unliberated mineral can be handled since the locked grains are said to accumulate in the screen oversize, which implies that unless some attempt is made to concentrate middling particles after the screening operation, the whole of the oversize would have to be ground.

In spite of some doubt as to the general applicability of the procedure, however, the work is a valuable contribution to the study of gravity concentration and is certainly worth attention.

RECOVERING GERMANIUM AT KIPUSHI

Union Minière du Haut Katanga recovers, by magnetic upgrading, a small portion of the germanium in a copper-germanium flotation concentrate from its Kipushi mine ore.

Germanium is present in renierite ((Cu, Ge, Fe, Zn, Ga)4(S,As)4), a ferromagnetic mineral sometimes called "orange bornite". It has similar chemical composition to germanite, but has a higher iron and lower germanium content—about 7.3 per cent Ge at Kipushi.

In the Kipushi mill, most of the ores are treated by selective flotation to produce a copper concentrate and a zinc concentrate. The first step is to make a primary copper concentrate high in copper and low in zinc for direct copper smelting. This concentrate recovers the chalcopyrite, chalcocite, galena part of the bornite, and also the renierite when ore being milled contains visible renierite.

Some germanium is present in both the zinc and secondary copper concentrates. The latter is added to the primary copper concentrate for smelting. From this, the residual germanium is partially recovered in smelter fumes; however, the most important portion is contained in the slag and will be recovered later, together with zinc, by a fuming process.

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A pilot plant with one type 461 Ferro Filter (16 amperes-110 volts) was set up in the mill to ascertain the practical conditions necessary for such an operation. In October, 1957, a full size plant using 12 type 461 Ferro Filters was commissioned. The process is essentially discontinuous for each separate filter.

The 12 Ferro Filters are arranged in four sets of three. In each set the filters are fixed to a disc rotating at one revolution in 135 seconds. A motionless triangular tub continuously distributes two volumes of pulp and one volume of clear water through separate launders suitably arranged to comply with the requirements of the cycles' different steps. The pulp, discharged from the three filters, flows into a circular tub located under the rotating disc and provided with radial partitions separating a sector of 80 deg. for the copper-germanium concentrates (step 3) and another of 280 deg. for the non-magnetic pulp (steps 1 and 2). Electric current is distributed by a rotating series of contacts, synchronized with the disc. The motor generator set can deliver up to 200 amp.

Three of the four sets of filters are normally in operation, while the fourth is idle for cleaning the inner grids. One Ferro Filter can handle up to 5.5 cu. m. (about 200 cu. ft.) of pulp with a content of 1,350 grm. of solids per litre per hour.

Flotation concentrate is screened on a Rotex screen ahead of the filters to separate as much wood pulp and trash from the mine as possible in order to minimize clogging of the inner grids of the filters. Top slicing is used in the mine so wood presents a difficulty in milling.

TRENDS OF COAL PREPARATION IN NORTHUMBERLAND AND DURHAM

In a paper contrasting the conditions for coal preparation in Durham and Northumberland, Ridley, Macpherson and Booth, describe how there has been a change-over from dry to wet methods in Durham and how the increasing sale of untreated dry smalls, particularly in Northumberland is influencing the pattern of preparation.

In Durham the trend is towards complete mechanical cleaning of all sizes, whereas in Northumberland large coal is washed, but there is a tendency to minimize the washing of smalls. This arises from the suitability of Durham coal for carbonization and Northumberland coal for steam raising and for domestic markets.

For a period of thirty years the Durham practice has developed on a basis of dry cleaning, supplying dry products for gas and coke production, but these methods have failed to meet the requirements of changed conditions partly due to dirtier coal and more particularly due to increased water content due to the greater use of wet methods of dust suppression.

In general, however, the changing conditions have been met by use of normal methods of cleaning by dense medium, by means of Baum jigs and flotation, coupled with improvements in design of screening and dewatering equipment. The conditions described, the authors say, cover most of the conditions prevailing in Britain and consequently the developments in these two counties are generally typical of British coal preparation practice.

THREE-WAY SEPARATION OF COPPER, LEAD AND ZINC IN COMPLEX ORE

The treatment of a complex low-grade ore containing gold, silver, copper, lead and zinc at the Pandora mill of Idarado Mining Co., in Colorado, has been described recently.

Free gold is recovered by jiggling and amalgamation, the concentrate from the rougher jigs in the grinding circuit being cleaned twice by re-jigging and on corduroy. A lead-copper concentrate is made using flotation where the sphalerite is depressed by means of sodium sulphite and zinc sulphate, and at the same time, pyrite is depressed with lime and a very small addition of cyanide. The use of this reagent must be carefully regulated and the addition kept as low as possible in order to avoid depression of chalcopyrite.

Cyanamid reagent 404 and xanthate Z-11 have been found to be good collectors for both copper and lead when combined and some Z-6 is added to the scavenger cells. This bulk concentrate is conditioned with reagent 622 to depress the chalcopyrite and thereby making a lead concentrate using three-stage flotation.

The sphalerite is simply recovered by adding Z-3 xanthate and raising the pH with the addition of lime.

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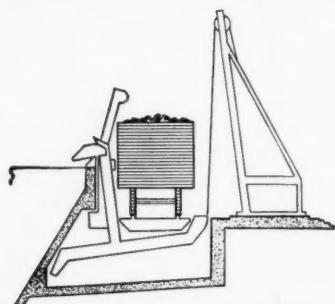
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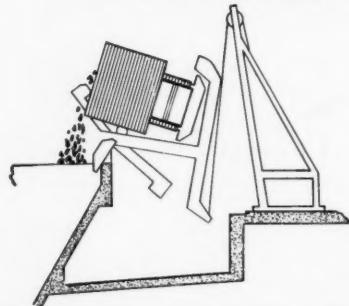
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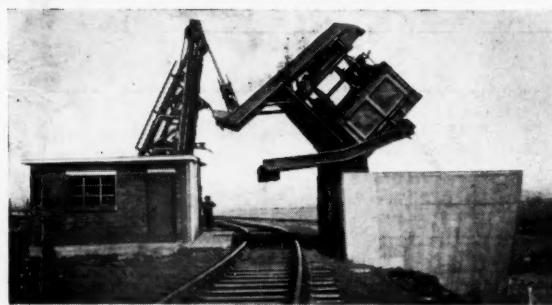
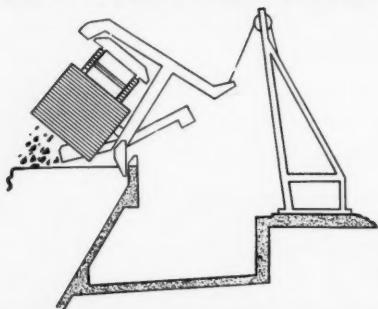
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